

1. A system for forced intra-coding of a digital video signal composed of a sequence of image frames that comprise an entire image, each image frame comprising a plurality of macroblocks of pixels, said system comprising:

an input for receiving an image frame of the digital video signal;

a first memory for storing one or more macroblock access arrays, each macroblock access array containing a list of macroblock identifiers corresponding to macroblock locations within a predetermined region of the image frame;

an intra-refresh macroblock location identification element, operably connected to said first memory, for selecting one or more macroblock refresh identifiers from said one or more macroblock access arrays;

comparison logic for comparing said macroblock refresh identifiers with an identifier of a current macroblock; and

a block-based coding element, operably connected to said comparison logic and to said input,

wherein said block-based coding element is operable to force intra-coding of said current macroblock if the identifier of the current macroblock is equal to any of the one or more macroblock refresh identifiers.

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2. A system as in claim 1 wherein at least one list of macroblock identifiers is a random permutation of the identifiers of macroblock locations within a corresponding predetermined region of the image frame.
3. A system as in claim 1, further comprising a second memory for storing said macroblock refresh identifiers.
4. A system as in claim 1, further comprising a second memory for storing an array of flags, one flag for each macroblock location, wherein said intra-refresh macroblock location identification element operates to set one or more flags within the array of flags that correspond to said macroblock refresh identifiers.
5. A system as in claim 4, wherein said block-based coding element is configured to force the current macroblock to be intra-coded if a corresponding flag within said array of flags is set.
6. A system as in claim 1, wherein said intra-refresh macroblock location identification element is operably connected to said input and is configured to select the one or more macroblock refresh identifiers whenever a new image frame is received by said input.
7. A system as in claim 1, wherein the digital video signal is spatially partitioned into one or more image regions covering the entire image.
8. A system as in claim 7, wherein the digital video signal is spatially partitioned into one or more mutually exclusive image regions.

9. A system as in claim 8, wherein the digital video signal is spatially partitioned into a plurality of mutually exclusive image regions comprising at least one interior image region containing no macroblock on an edge of the image frame and at least one exterior image region containing at least one macroblock on the edge of the image frame.
10. A system as in claim 9 wherein the at least one interior image region contains fewer macroblocks than the at least one exterior image region.
11. A system as in claim 8, wherein each boundary of the one or more mutually exclusive image regions is coincident with a macroblock boundary.
12. A system as in claim 7, wherein one or more of the one or more image regions are overlapping.
13. A system as in claim 1, wherein said block-based coding element is operable to code said current macroblock according to a standard video coding protocol if the identifier of the current macroblock is not equal to any of the one or more macroblock refresh identifiers.
14. A method for reducing error propagation in a digital video signal by forced intra-coding of macroblocks, said method comprising:

receiving, from the digital video signal, a digital video frame comprising a plurality of macroblocks, each macroblock of the plurality of macroblocks comprising a plurality of pixels;

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retrieving a predetermined number of macroblock refresh identifiers from one or more macroblock access arrays, each macroblock access array of the one or more macroblock access arrays containing a list of macroblock identifiers from one or more lists of macroblock identifiers corresponding to a plurality of macroblock locations of one or more identified macroblocks of the plurality of macroblocks within a corresponding region of the digital video frame; and

Intra-coding the one or more identified macroblocks corresponding to said macroblock refresh identifiers.

15. A method as in claim 14, wherein at least one list of the one or more lists of macroblock identifiers is a random permutation of the identifiers of macroblock locations within the corresponding predetermined region of the digital video frame.

16. A method as in claim 14, further comprising:

storing said macroblock refresh identifiers in a memory.

17. A method as in claim 14, further comprising:

storing an array of flags, one for each macroblock location of the plurality of macroblock locations, in a memory; and

setting those flags within the array of flags that correspond to said macroblock refresh identifiers.

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18. A method as in claim 17, further comprising:

determining if a flag of said array of flags corresponding to a macroblock is set; and

intra-coding said corresponding macroblock if said flag is set.

19. A method as in claim 18, further comprising:

coding said corresponding macroblock accordance with a standard video coding protocol if said flag is not set.

20. A method as in claim 14, further comprising:

coding one or more macroblocks of said plurality of macroblocks not at locations corresponding to said macroblock refresh identifiers according to a standard video coding protocol.

21. A method as in claim 20, wherein the standard video coding protocol is one of H.261, H.263, MPEG1, MPEG2 and MPEG4.

22. A method as in claim 14, further comprising:

determining each predetermined region of a plurality of defined regions of the digital video frame in accordance with the size of the digital video frame.

23. A method as in claim 14, wherein a plurality of regions of the digital video frame are predetermined.

24. A method is in claim 23, wherein the plurality of regions comprises four regions.

25. A method as in claim 23, wherein at least one region of the plurality of regions is an interior region containing no macroblock on an edge of the digital video frame and at least one region of the plurality of regions is an exterior region containing at least one macroblock on the edge of the digital video frame.

26. A method as in claim 25, wherein the at least one interior region comprises fewer macroblocks than the at least one exterior region.

27. A computer readable medium containing instructions which, when executed on a computer, carry out a process of coding a digital video image, said process comprising:

receiving a digital video frame comprising a plurality of macroblocks, each macroblock comprising a plurality of pixels;

retrieving a prescribed number of macroblock refresh identifiers from one or more macroblock access arrays, each macroblock access array of the one or more macroblock access arrays containing a list of macroblock identifiers corresponding to a plurality of macroblock locations within a prescribed region of the digital video frame; and

intra-coding one or more macroblocks of the plurality of macroblocks residing at locations corresponding to the macroblock refresh identifiers.

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28. A device for coding digital video data of a digital image, comprising:

a first input for receiving uncompressed digital video data;

a first output for transmitting compressed digital video data;

a memory for storing one or more macroblock access arrays, each macroblock access array of the one or more macroblock access arrays containing a list of macroblock identifiers corresponding to a plurality of macroblock locations within a predetermined region of the digital image;

an intra-refresh macroblock location identification element, operably connected to said memory, for selecting one or more macroblock refresh identifiers from said one or more macroblock access arrays;

comparison logic for comparing said macroblock refresh identifiers with an identifier of a current macroblock; and

a block-based coding element, operably coupled to said comparison logic, said first input and said first output,

wherein said block-based coding element is operable to force intra-coding of said current macroblock if the identifier of the current macroblock is equal to any of the one or more macroblock refresh identifiers.

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29. A device as in claim 28 further comprising:

a second input for receiving compressed digital video data;

a second output for transmitting uncompressed digital video data; and

a block-based decoding element operably coupled to said second input and said second output.

wherein said block-based decoding element operates to decode the compressed digital video data and thereby recover the uncompressed digital video data.

30. A device for coding a sequence of digital video frames, each digital video frame comprising a plurality of macroblocks and each macroblock comprising a plurality of pixels, wherein operation of the device is controlled by a computer program that is embedded in at least one of:

(a) a memory;

(b) a digital signal processor;

(c) an application specific integrated circuit coupled to the digital signal processor; and

(d) a field programmable gate array,

wherein the computer program comprises:

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retrieving a predetermined number of macroblock refresh identifiers from one or more macroblock access arrays, each macroblock access array containing a list of macroblock identifiers from one or more lists of macroblock identifiers corresponding to macroblock locations within a predetermined region of the digital video frame; and

intra-coding one or more macroblocks at locations corresponding to said macroblock refresh identifiers.

31. A device as in claim 30, further comprising:

a macroblock memory for storing the macroblock access arrays.

32. A device as in claim 30, wherein said computer program further comprises:

coding one or more macroblocks not at locations corresponding to said macroblock refresh identifiers in accordance with a standard video coding protocol.

33. A device as in claim 30 in which a list of macroblock identifiers of the one or more lists of macroblock identifiers is a random permutation of the identifiers of macroblock locations within the corresponding predetermined region of the digital video frame.

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34. A method for reducing error propagation in a digital video signal by forced intra-coding of macroblocks, said method comprising:

receiving a sequence of digital video frames, each digital video frame comprising one or more regions, each region comprising a plurality of macroblocks and each macroblock comprising a plurality of pixels;

generating, for each of the one or more regions, a macroblock access array containing a list of macroblock identifiers corresponding to macroblock locations within that region;

for each frame of the sequence of digital video frame, further comprising:

retrieving, for each of the one or more regions, a predetermined number of macroblock refresh identifiers from a corresponding macroblock access array; and

intra-coding one or more macroblocks of the plurality of macroblocks at locations corresponding to said macroblock refresh identifiers,

wherein an order of the list of macroblock identifiers in each macroblock access array is determined by an output of a pseudo-random number generator.

35. A method as in claim 34, further comprising:

coding one or more macroblocks not at locations corresponding to said macroblock refresh identifiers in accordance with a standard video coding protocol.

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